NGST

TRW

Presentation to American Astronomical Society NGST Town Hall Meeting

Dennis Ebbets

on behalf of the TRW/Ball Team

January 12, 2000

Outline

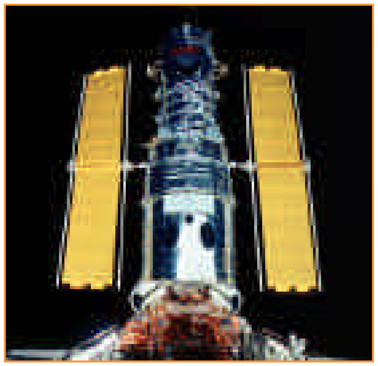
1. Team experience and contacts
2. Overview of the concept
3. Technology for the primary mirror
4. Estimates of performance
5. Comments about the ISIM and SI selection

Our team has experience and capabilities that are important to NGST

TRW

Ball

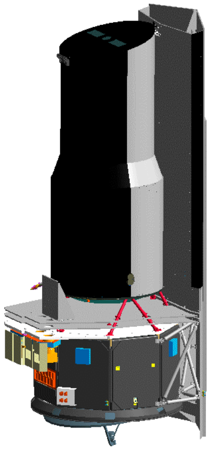
- Participation in all of the Great Observatories
  - Hubble Space Telescope (HST)
  - Compton Gamma Ray Observatory (CGRO)
  - Advanced X-ray Astrophysics Facility (Chandra)
  - Space Infrared Telescope Facility (SIRTF)
- Cryogenic telescopes and instruments
  - IRAS
  - COBE
  - NICMOS
  - SIRTF
- Large deployable structures
- Lightweight optics, metrology and control



HST
1990

CGRO
1991

Chandra
1999



SIRTF
2001

- Both companies have participated in NGST studies for many years

Key contacts on the TRW / Ball Team

Program Management

Program Managers - Ralph Schilling, Doug Neam
Senior Advisors - Jim Crocker, Greg Davidson
Lead Technologist - Paul Lightsey
Project Scientist - Dennis Ebbets
Program Operations - Doug Au
Contract Mgmt - Mike Leonard

Systems Engineering

Cindy Woo
Paul Lightsey

- End-to-end architecture
- Interface requirements
- System integration and performance verification planning
- Integrated modeling
- Technology planning
- Risk and trade analysis
- Support to Nexus
- Initial NGST design

Optical Telescope Assembly

Scott Texter
Doug Neam

- Definition
- Analyses and modeling
- Technology development
- Interfaces

Integrated Science Instruments Module

Jim Crocker
Dennis Ebbets

- System concepts
- Architecture compatibility
- Interfaces
- I&T
- Individual SIs

Ground Segment and Operations

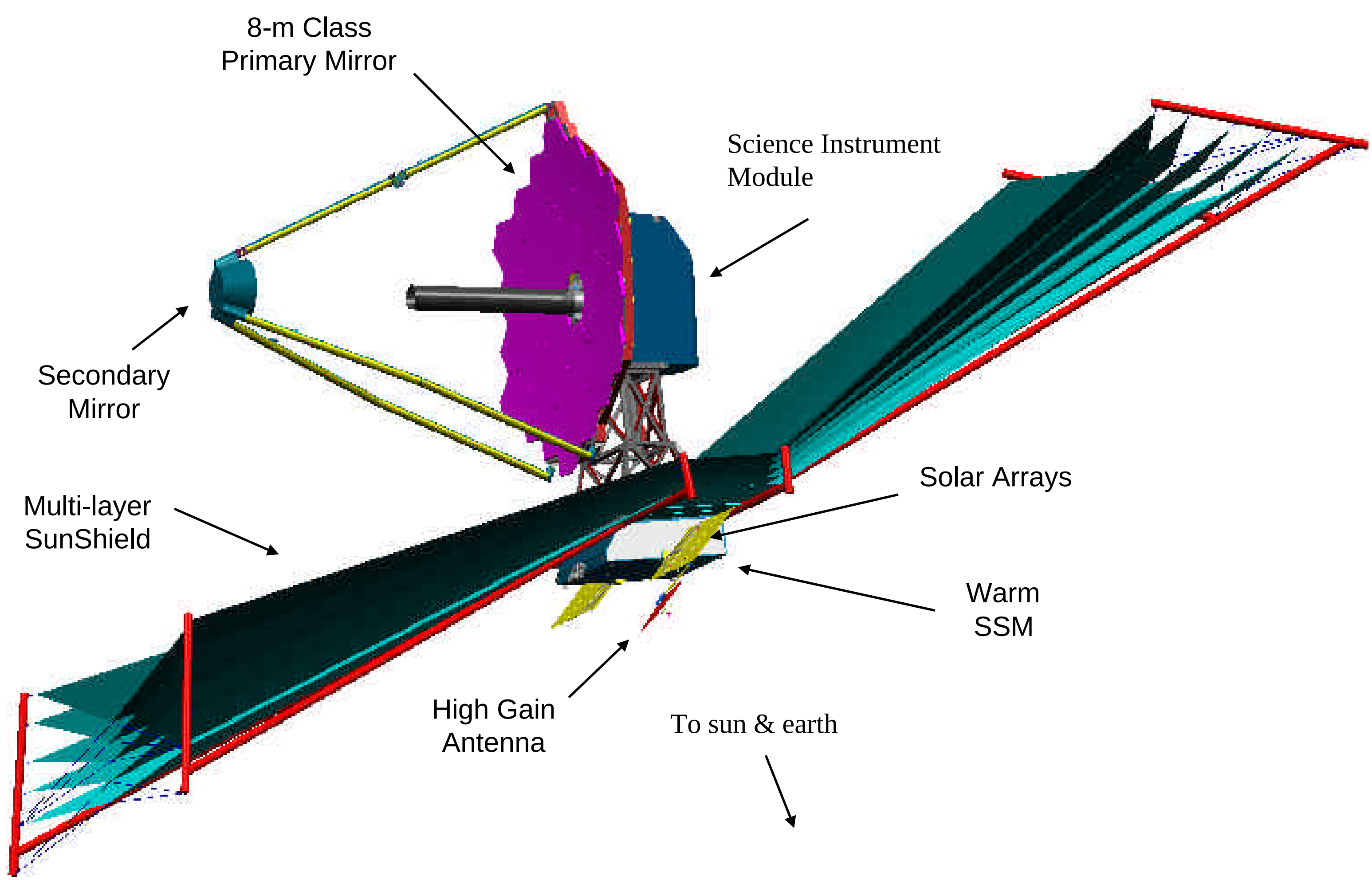
Wendy Watson

- Definition
- Interfaces
- Flight software
- Space/Ground allocations

www.trw.com/ngst
www.ballaerospace.com

Our observatory concept is guided by NGST science objectives

Sensitivity for faint targets, angular resolution, image quality
wide wavelength range, low backgrounds



-2000 AAS NGST

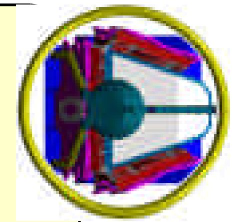
Chord fold allows large collecting area & large diameter with precision optical surface

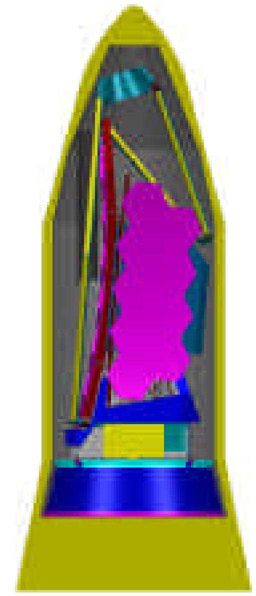
Very good way to stow the Primary Mirror for launch

- minimum complexity for 8m Primary Mirror

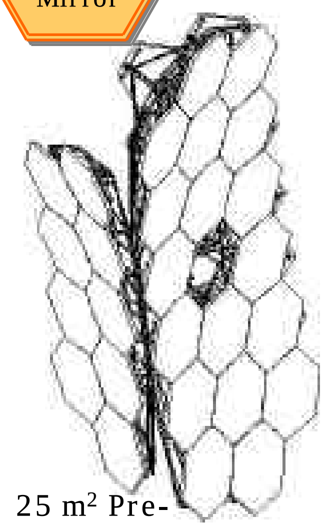
It is compatible with a variety of mirror technologies

- Beryllium segments with active control is an attractive approach

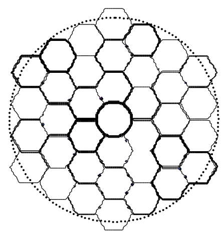


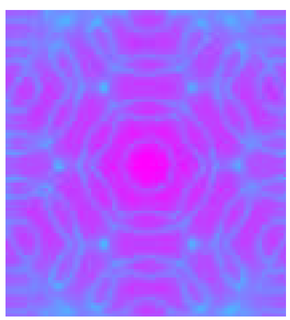


36 Hex Primary Mirror

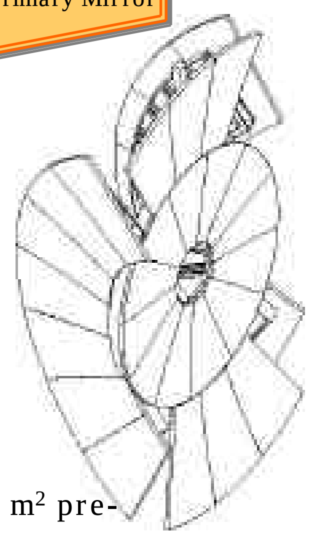


25 m^2 Pre-deployed area

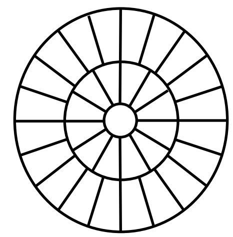


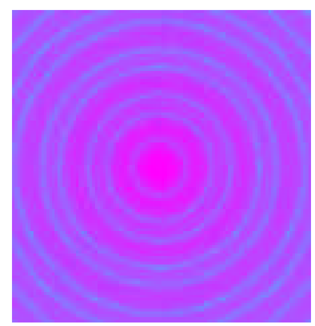


12/20 Keystone Primary Mirror



24 m^2 pre-deployed area





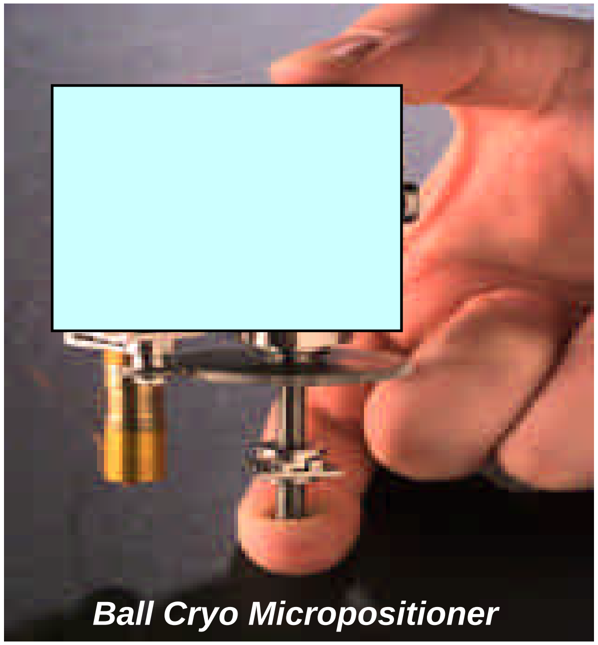
Core of psf nearly indistinguishable from Airy disk
D = 0.12”, ee = 0.72, Strehl = 0.8

We are developing the technology needed to enable this approach

Subscale Beryllium Mirror Demonstrator

Semi-rigid all Be segment
areal density of 9.8 kg/m^2
ambient and cryo tests completed
met optical surface figure goals
ambient - cryo figure differences OK
demonstrated ROC control
interfaces for support and actuators

Cryogenic micro-positioner



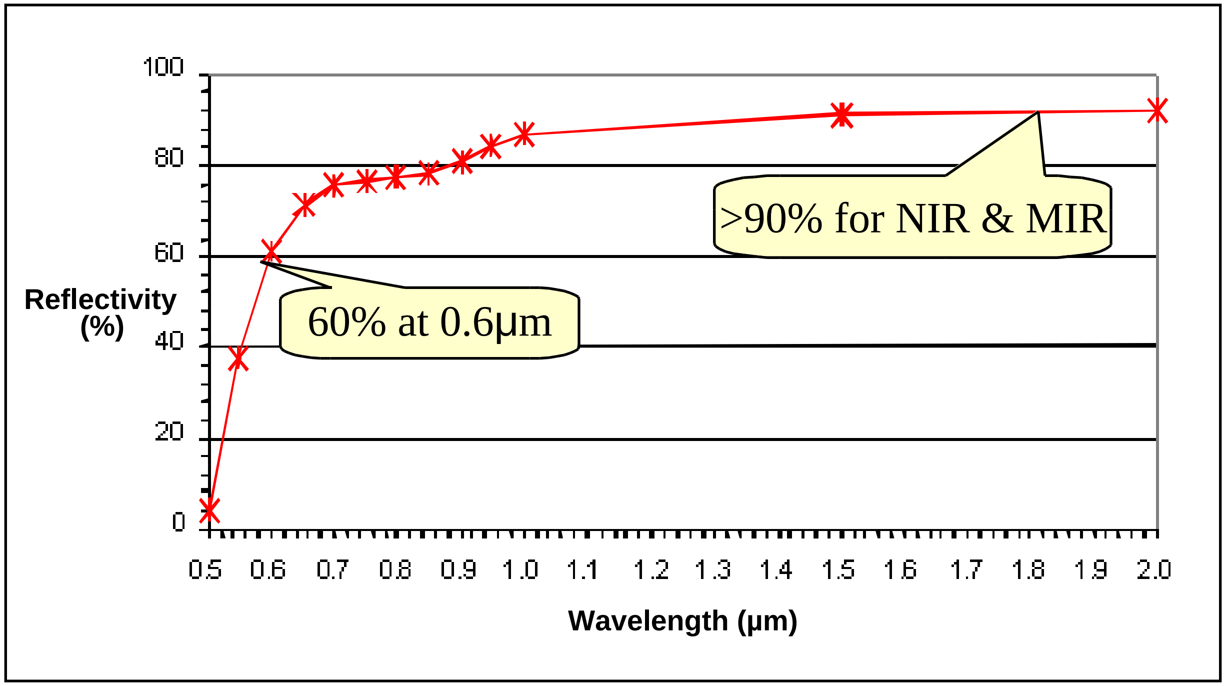
Ball Cryo Micropositioner

Small, lightweight, strong
98mm length, 135gms
20K - 340K temperature range
ambient and cryo tests completed
coarse motion 25mm range, 1µm steps
fine motion 8µm range, 10nm steps

Throughput for visible wavelengths will be influenced by choice of optical coatings

Possibly 9 or more surfaces
Al, Au, Ag options

example:
1 Al + 4 Au + 4 Ag gives good performance

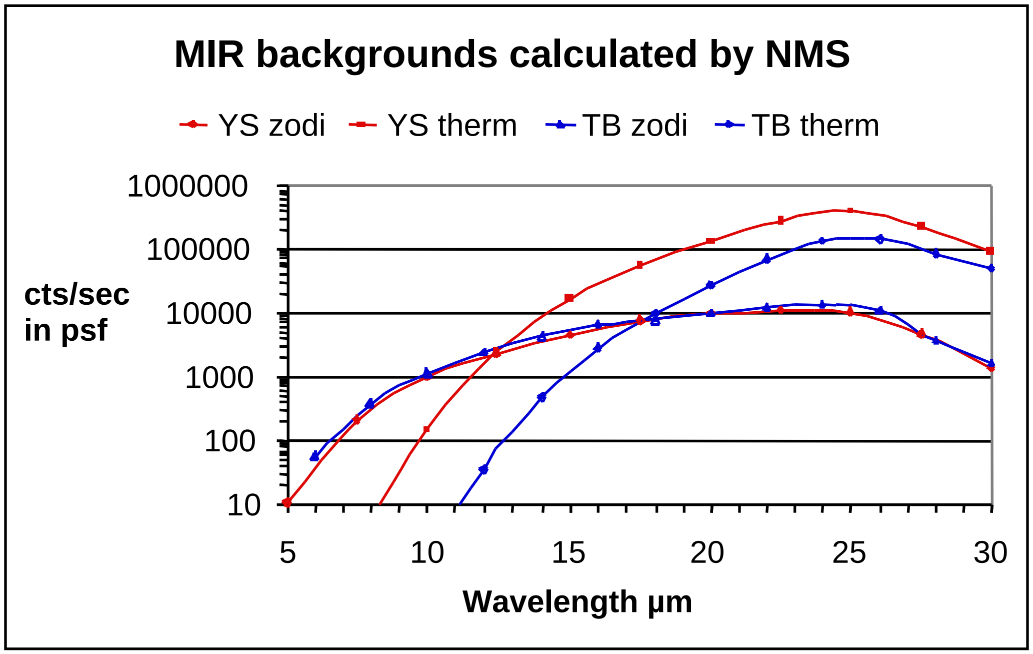


We expect good performance from the sunshield

Passive cooling of OTA to T < 40K and ISIM to T   30K
Low MIR background, Zodi limited to λ > 12μm
Durability and long-life performance under study
Experience with systems in geo-synchronous orbits is encouraging

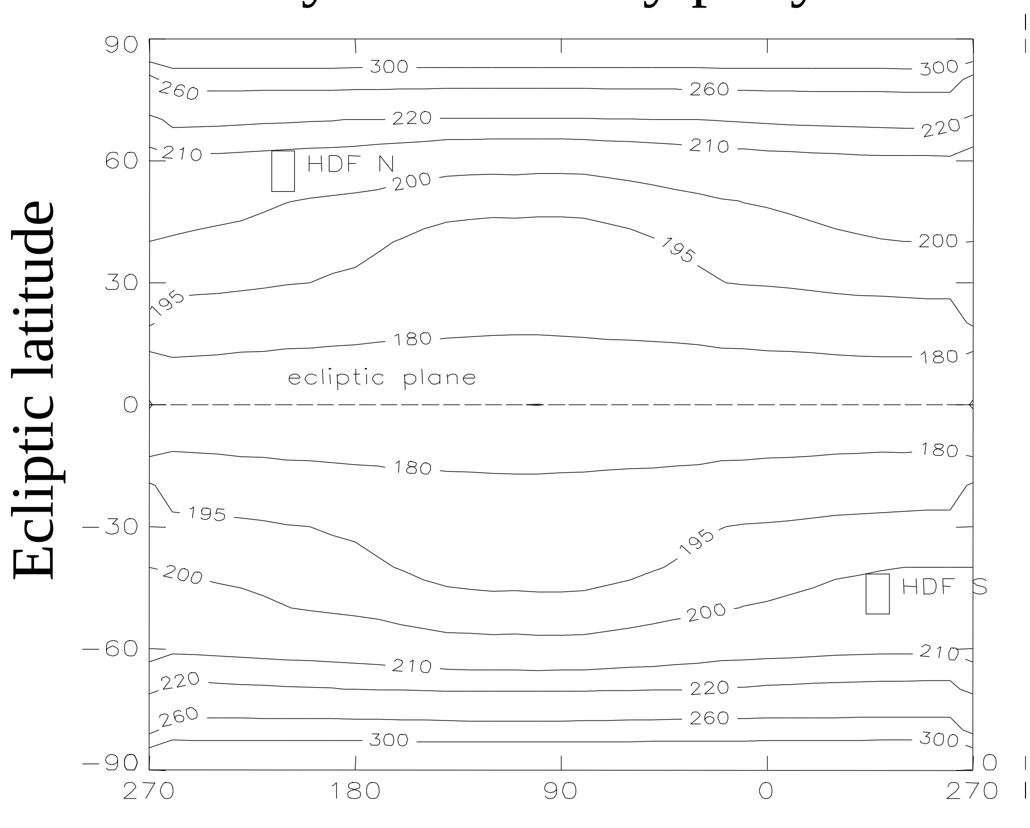
Comparison to Yardstick

Identical zodi
Lower thermal emission
  cooler sunshield
  smaller viewfactors
Longer cross-over λ



Field of Regard affects operational flexibility and long term scientific productivity

Days of visibility per year

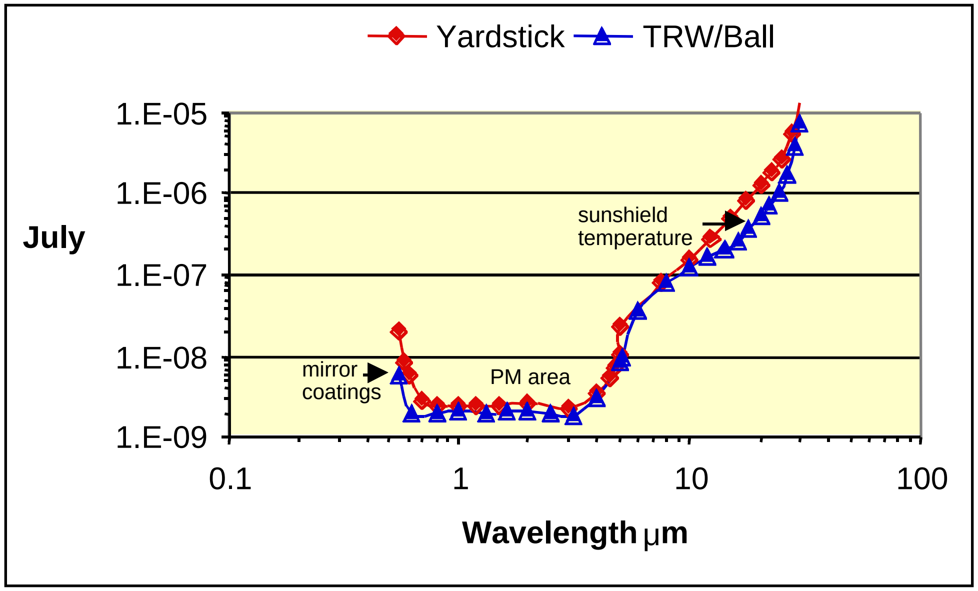


Ecliptic longitude

Sunshield affects Field of Regard
>85º from sun
>15 º from anti-sun
360 º roll about sun line
53% of celestial sphere visible

Benefits include:
all targets accessible > half the year
high latitudes accessible > 7 months
long continuous campaigns
revisits for time variability
response to targets of opportunity
scheduling flexibility
retry failed observations

The performance of our design compares favorably to that of the Yardstick



Sensitivity

NMS v 2.5

point source images

t = 1 hour

R = 5

S/N = 5

zodi = ecliptic pole

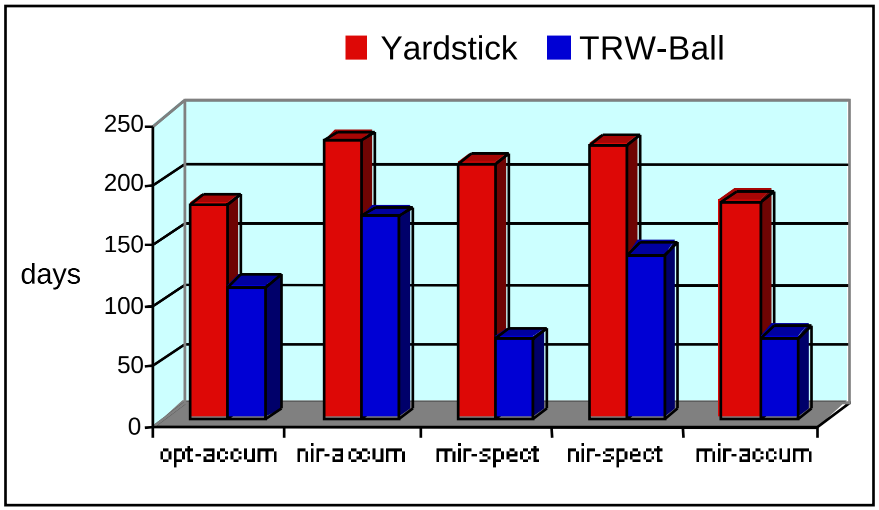
DRM Completion Time

DRM v 2.2

NMS MET v 2.5

Yardstick = 2.8 yrs

TRW/Ball = 1.6 yrs



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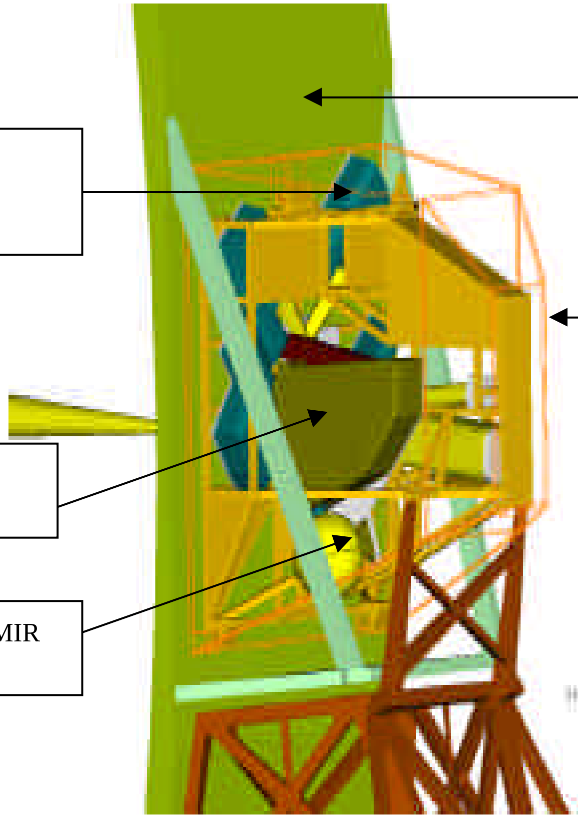
Our architecture is compatible with a Yardstick like suite of science instruments



Excerpt from engineering study of ISIM interfaces

Thoughts about ISIM and SIs

Area and volume should be adequate
Mass will be a precious commodity
WFE error budget will be tight
FOV can accommodate several SIs
Adequate passive cooling for NIR FPAs
Sunshield durability will preserve value of MIR
Pointing control and data management
will be designed to instruments' requirements

Concluding Remarks

We think we have a viable concept that is responsive to the scientific and programmatic priorities of NGST

Our approach is "MIR Compatible"

We have considerable flexibility for ISIM accommodation

- We have been participating in SI and ISIM studies
- We are following the selection process with interest

We solicit dialogue and inputs from the community